Resource Action: EWG-93A/B	**Task Force Recommendation Category: 2**

Through Either Mechanical or Hydraulic Changes, Improve the: (A) Spawning and Rearing Habitat for Salmonids and Steelhead in the Low Flow Channel, and (B) Spawning Habitat for Splittail in the Lower Feather River

Date of Field Evaluation: No field evaluation was conducted. This measure was discussed at a meeting at DWR, Red Bluff on August 15, 2003.

Evaluation Team: Richard Harris with input from Phil Unger, Koll Buer and Dave Olson.

Description of Proposed Resource Action:
Mechanical or hydraulic changes to river geomorphology have been suggested to improve fish habitat. This Resource Action could include several options, such as leveling off selected gravel bars so they are inundated at particular flows, digging side-channels that provide suitable velocity and cover for juvenile fishes, and reconfiguring selected sections of the stream channel to establish additional inundated benches for splittail spawning habitat.

There are several other Resource Actions that are either similar to or otherwise related to this measure:

- EWG-16A and EWG-16B, that propose to create or enhance side channel habitat in the low flow reach.
- EWG-19A and EWG-22, that propose levee setbacks and creation of floodplain benches in the lower Feather River.
- EWG-92 and EWG-18, that propose salmonid spawning habitat improvements in the low flow channel.

Nexus to the Project:
A number of things have contributed to degradation of fisheries habitat conditions in the Feather River. These include historic instream mining operations, levees and floodplain land uses. The construction of Lake Oroville and its operations for water supply, hydropower generation and flood control continue the process of degradation because of sediment trapping behind the dam and flow regulation.

Potential Environmental Benefits:
This measure is not well-defined either in location or proposed treatments. Consequently, its benefits can only be generally described. The measure consists of at least three potential elements: creation of side-channels in the low flow reach, leveling gravel bars to make them more accessible to streamflow (no locations specified) and creating geomorphic surfaces to benefit splittail in the Feather River below Honcut

Creek (splittail are not observed in the low flow channel, see attached fish distribution map).

The proposal to create side-channels in the low flow channel to benefit juvenile fishes (salmonids) is similar or identical to measures proposed in EWG-16A and EWG-16B. As indicated in the evaluations for EWG-16A and EWG-16B, creation of side-channel habitat at various locations in the low flow reach would increase rearing habitat for juvenile salmonids. This would potentially increase escapement of naturally produced steelhead trout and Chinook salmon.

The proposal to level off gravel bars to make them more accessible to streamflow could potentially have several benefits including enhancement of salmonid spawning or rearing habitat, improvement of splittail habitat and enhancement of riparian vegetation recruitment. It is similar to EWG-19A that proposes to modify or construct geomorphic surfaces in the lower Feather River. It is also similar to EWG-18 that would modify spawning areas by ripping or raking.

The measure also proposes to modify or create geomorphic surfaces to improve habitat conditions for spawning splittails. Splittails commonly spawn in vegetated floodplains during flood stage. The juveniles then enter main channels as floods recede. It is assumed that this measure would be implemented in the lower Feather River, below Honcut Creek. It is therefore, similar or identical to EWG-19A and EWG-22 that also propose improvement of splittail habitat in essentially the same way.

Potential Constraints:
Since the creation of side channels in the low flow reach and creation or modification of benches or other floodplain surfaces in the lower Feather River are essentially the same as other measures (EWG-16A, EWG-16B, EWG-19A and EWG-22), the same constraints would apply. These primarily relate to the need for a complementary flow regime that will make these measures work. Additional constraints include the potential for changing streamflow patterns in unpredictable ways and short-term instream construction and water quality impacts.

Existing Conditions in the Proposed Resource Action Implementation Area:
Because of the lack of geographic specificity in this measure, parts of it could be implemented in different sections of the Feather River. It is assumed however, that side-channel habitat creation would be done in the low flow channel, that gravel bar leveling could be done anywhere and that splittail habitat improvements would be done in the lower Feather River, below Honcut Creek. Conditions in the low flow channel and lower Feather River have been described in reports on other Resource Actions (EWG-13A, EWG-13B, EWG-16A, EWG-16B, EWG-19A, EWG-22, EWG-89, and EWG-92). The discussion below focuses on those specific environmental conditions that would be relevant to this proposed measure.

A. Low Flow Channel:

Potential side channel habitat improvements in the low flow channel are described and evaluated in the reports on EWG-16A and EWG-16B. According to the evaluations for EWG-16A and EWG-16B, rearing habitat for juvenile salmonids is limiting in the low flow reach, particularly from the Highway 70 bridge downstream to Robinson Riffle. EWG-16A proposes creation of side channel habitat in several locations including Robinson Riffle/Borrow Pond, Steep Riffle, between Eye and Gateway Riffles, Aleck Riffle and Great Western Riffle. EWG-16B proposes increasing rearing habitat at Moe's Ditch and Hatchery Ditch, which are not part of the main channel system.

The greatest diversity of instream habitat types is found in the upper low flow reach (River Mile (RM) 67 to RM 65.5) and from Robinson Riffle to Gateway Riffle (lower 2.5. miles). The middle section of the low flow reach (RM 65.5 to RM 62) is mostly pool habitat with little topographic diversity. Most fluvial deposits in the low flow reach are inundated by flows >50,000 cubic feet per second (cfs). Opportunities for leveling gravel bars to make them accessible to streamflow are limited. There are some bars and islands that could be graded down to the 600 cfs stage height. However, these are presently stable and fully vegetated.

B. Lower Feather River:

The lower Feather River (especially below Gridley) is presently incised in hydraulic mining debris (10-25 feet). Studies conducted by DWR indicate that the Rosgen classification for the lower Feather River is "entrenched, F channel type." Under SP G2 the geomorphic reaches in the lower Feather River have been categorized. From RM 59 (Thermalito) to RM 0 (Sacramento confluence) eight reaches were defined. Two sections (RM 39 to RM 54 and RM 34 to RM 35.5) presently have a high degree of instream geomorphic diversity (i.e., islands, bars). They also have moderate to high sinuosity with well-developed point bars. The substrate in RM 39 to RM 54 is gravel, and at RM 34 to RM 35.5 it is sand and gravel. In both areas, levees are well set back from the stream on at least one side.

For the remainder of the lower Feather River, the channel crossection is roughly trapezoidal, the channel is relatively wide, and there are relatively few floodplain surfaces. Those surfaces that do exist are mostly sand substrate, and the channel bottom itself is predominately heavy clay.

Vegetation and gravel bar mapping indicates that between the Yuba and Sacramento River confluences with the Feather River there are presently few locations with a combination of geomorphology and emergent, herbaceous vegetation that are suitable for splittail spawning habitat (see attached figures). (See splittail lifehistory matrix for information on the spawning habitat requirements for this species.) Likewise, there are few opportunities for modifying existing gravel bars to make them more accessible to streamflow.

Design Considerations and Evaluation:
As pointed out in every evaluation for measures that propose channel or floodplain changes, the success of any geomorphic construction project will depend on the future flow regime. In this instance, leveling of bars, creation of side channels or benches or similar steps taken to improve habitat will provide uncertain benefits unless coordinated with a flow management strategy. For example, if existing islands or bars are to be graded to expose them inundation, what elevation should they be leveled to? Currently in the low flow channel, the regulated flow regime is always about 600 cfs. Should that be used as the design discharge? At the present time, peak flows in excess of 100,000 cfs periodically occur due to flood control releases. Flows of this magnitude would probably erase most created geomorphic surfaces from the low flow channel (see discussion in the evaluation of EWG-16A). Until a flow management strategy has been developed for the river, it is premature to create detailed designs for geomorphic construction. Also, if a flow regime similar to a natural flow regime is instituted with periodic peak flows, artificial creation of geomorphic surfaces may be unnecessary since the streamflow may do the work of creating surfaces. For example, side channels were naturally created by the 1997 flood in the low flow reach. This point is raised in the evaluation for EWG-16A as well.

Another major consideration for this measure is the potential effects of geomorphic changes on channel behavior. As with all measures that would obstruct or change flows (e.g., EWG-13A, EWG-13B, EWG-16A,) or change the channel crossection (e.g., EWG-89) there will be uncertainty about future channel movements. Although there is modeling capability available to predict future channel changes, these will be subject to validation in an uncontrolled experiment.

Implementing any element of this measure would require moving large volumes of gravel using heavy earth-moving equipment. Such activities have the potential to produce water quality problems, particularly high turbidity. Therefore, construction should be restricted to a time of year when sensitive life stages of salmonids and other species are least abundant in the river. Spring-run Chinook salmon spawn from about mid August through October, fall-run Chinook spawn from about September through December, and steelhead spawn from about November through June. Fry of all three species emerge from their redds in the late winter or spring and most of the salmon have emigrated by June. Splittail spawn in February-March and may be present in the river from about January-April. Therefore, July through mid-August is probably the best period of the year for avoiding impacts on sensitive life stages of these species. In addition, the July to mid-August period has little rainfall and low river flows, so mobilization of disturbed sediments would be minimized at this time.

Because of the potential impacts of any in-channel work, permits will be required from the Department of Fish and Game, State Water Quality Control Board and US Army Corps of Engineers, at the minimum.

Further details on specific design considerations for side channel habitat creation and improvement of habitat for splittail are presented in the reports on EWG-16A, EWG-16B and EWG-19A.

Synergism and Conflicts:
The overlap of this measure with other measures suggests that there should one programmatic measure encompassing all proposed geomorphic restoration efforts. Then, the compatibilities and potential conflicts between different approaches could be evaluated more comprehensively.

Uncertainties:
As discussed above, the main uncertainties with geomorphic restoration measures pertain to the need for a coordinated flow management strategy, potential effects on channel behavior and performance during occasional peak flow events.

Cost Estimate:
The range of options presented in this measure is so broad that providing detailed cost estimates is not possible. The reader is referred to other narrative reports for information on specific costs for specific actions (EWG-16A and EWG-16B for side channels; EWG-19A , EWG-22 and EWG-89 for other geomorphic restoration). It is likely that creation of side channels and modification or creation of geomorphic surfaces will be relatively expensive when compared to less radical measures. Costs will be driven by planning and design considerations, environmental protection during construction and the use of heavy earthmoving equipment.

Recommendations:
It is recommended that the separate components of this measure be combined with other Resource Actions proposing the same things. For example, side channel habitat improvements in the low flow reach could be combined with EWG-16A and EWG-16B. Splittail habitat improvements in the lower Feather River could be combined with EWG-19A and/or EWG-22. Proposed changes to gravel bars should be considered in combination with EWG-92 and EWG-18 that involve gravel replenishment or gravel bar ripping and raking. Any proposed geomorphic changes should be evaluated in conjunction with proposals to change the flow regime.

As an option, one programmatic measure dealing with all types of geomorphic restoration aimed at fisheries habitat improvement should be used as an umbrella for all the separate measures. This would ensure more coordinated evaluation of the various conflicts and synergisms between the various measures. It would also provide a basis for modeling effects in relation to alternative flow regimes.

Attachments:
Bear-Sacramento.pdf
Splittail lifehistory matrix.doc
Yuba-Bear.pdf
Splittail distribution.pdf